

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
3 June 2004 (03.06.2004)

PCT

(10) International Publication Number  
**WO 2004/047153 A2**

(51) International Patent Classification<sup>7</sup>: **H01L**

(21) International Application Number:  
PCT/US2003/037198

(22) International Filing Date:  
20 November 2003 (20.11.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/428,119 20 November 2002 (20.11.2002) US

(71) Applicant (for all designated States except US): **BERKSHIRE LABORATORIES, INC.** [US/US]; 864 Morrison Road, Columbus, OH 43230 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **MORTENSON, Mark, G.** [US/US]; 105 Deer Path Lane, North East, MD 21901 (US).

(74) Agent: **MORTENSON, Mark, G.** The Law Offices of Mark G. Mortensen; Post Office Box 310, North East, MD 21901-0310 (US).

(81) Designated States (*national*): AE, AG, AL, AU, BB, BG, BR, BW, CA, CN, CO, CR, CU, CZ, DM, DZ, EC, EE, EG, GD, HR, HU, ID, IL, IN, IS, JP, KP, KR, LC, LK, LR, LS, LT, MA, MG, MK, MX, NZ, PL, RO, SG, SK, TR, TT, UA, UG, US, UZ, VC, YU, ZA.

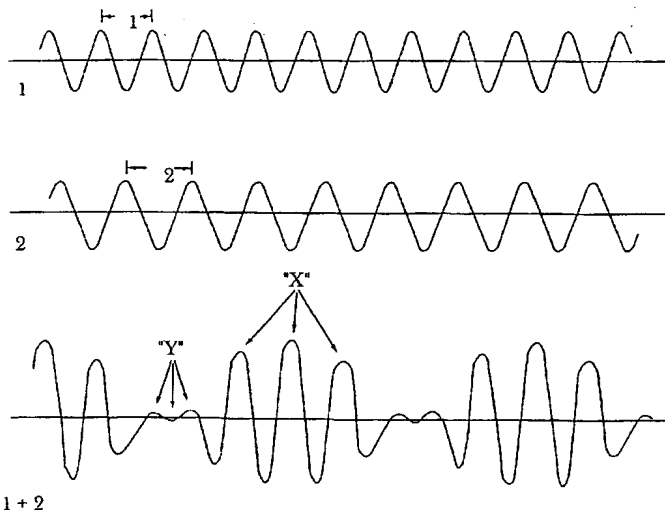
(84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: HIGH EFFICIENCY SOLAR CELLS



(57) Abstract: The present invention relates to improvements in solar cell and solar panel photovoltaic materials which cause the solar cells/panels to operate more efficiently. In particular, the present invention focuses primarily on matching or modifying particular incident light energies (e.g., solar energies) within the photoreactive portion of the solar spectrum to predetermined energy levels in a solar cell photovoltaic substrate material (e.g., a semiconductor material) required to excite, for example, electrons in at least a portion of the substrate material in a desirable manner (e.g., to cause desirable movement of electrons to result in output amperages previously unobtainable). In this regard, for example, energy levels of incident light within the optical or visible light portion of the solar spectrum (i.e., the photoreactive portion of the solar spectrum) and thus, corresponding particular wavelengths or frequencies of incident light, can be at least partially matched with various desirable energy levels (e.g., electron band gap energy levels)

in a substrate material by filtering out at least a portion of certain undesirable incident light from the photoreactive portion of the solar spectrum that comes into contact with at least a portion of a surface of a solar cell photovoltaic substrate material; and/or modifying at least a portion of a solar cell photovoltaic substrate material such that the solar cell substrate material interacts more favorably with particular desirable frequencies of incident light in the photoreactive portion of the solar spectrum; and/or modifying particular undesirable light energies within the band of optical or visible light wavelengths to which the photovoltaic substrate material is sensitive prior to such undesirable light energies becoming incident on the photovoltaic substrate material to render such light energies more desirable for interactions with the photovoltaic substrate material.

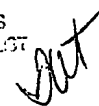
WO 2004/047153 A2

Rec'd PCT/PTO 19 MAY 2005

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/37198

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(7) : H01L 31/052, 31/04 US CL : 136/246, 257, 259; 257/432, 436 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) U.S. : 136/246, 257, 259; 257/432, 436 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 02/093657 A1 (MORTENSON) 21 November 2002 (21.11.2002), claims 1-16 at pages 17 and 18.	1-16
X	US 3,076,861 A (SAMULON et al) 05 February 1963 (05.02.1963), column 1, lines 29-72.	1-6, 14
Y		7-13, 15, 16
X	US 4,151,005 A (STREBKOV et al) 24 April 1979 (24.04.1979), column 8, lines 29-52.	1-6, 14
Y		7-13, 15, 16
X	US 4,293,732 A (RANCOURT et al) 06 October 1981 (06.10.1981), column 3, lines 21-49.	1-6, 14
Y		7-13, 15, 16
X	US 4,963,196 A (HASHIMOTO) 16 October 1990 (16.10.1990), column 1, lines 48-65.	1-4, 6, 14
Y		5, 7-13, 15, 16
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 27 April 2004 (27.04.2004)		Date of mailing of the international search report 20 MAY 2004
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230		Authorized officer Alan Diamond Telephone No. 571-272-1700 

## INTERNATIONAL SEARCH REPORT

PCT/US03/37198

## C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 6,107,564 A (AGUILERA et al) 22 August 2000 (22.08.2000), column 1, lines 4-20.	1-6, 14 — 7-13, 15, 16
Y	US 3,743,847 A (BOLAND) 03 July 1973 (03.07.1973), column 3, lines 15-35.	1-15
Y	US 4,278,829 A (POWELL) 14 July 1981 (14.07.1981), column 1, lines 44-68.	1-16
X — Y	JP 6-321579 A (KONDO et al) 22 November 1994 (22.11.1994), pages 1 and 2.	1-6, 14 — 7-13, 15, 16
X — Y	JP 9-162435 A (YAMAGOU et al) 20 June 1997 (20.06.1997), pages 2-3.	1-6, 14 — 7-13, 15, 16
A	JP 62-81777 A (MIZUKAMI) 15 April 1987 (15.04.1987).	1-16